Library Management (M.Tech Software Engineering /2022mt93331)

Version Number	Date	Author/Owner	Description of Change
01	01-August-2023	SHELKE AKSHAY NANDKUMAR	Problem statement, Requirements Definition, Features identification, Project plan etc.
02	02-August-2023	SHELKE AKSHAY NANDKUMAR	Project features and project plan updated
03	20-August-2023	SHELKE AKSHAY NANDKUMAR	Conceptual Design Phase details updated
04	05-Sept-2023	SHELKE AKSHAY NANDKUMAR	Logical Design Phase details updated
05	19-Oct-2023	SHELKE AKSHAY NANDKUMAR	Physical Design Phase details updated
06	26-Oct-2023	SHELKE AKSHAY NANDKUMAR	Demo recording, documentation, reports, and final doc details updated

I. REQUIREMENT SPECIFICATION

1. Problem Statement & Requirements Definition

LIBRARY MANAGEMENT SYSTEM:

The ***Library Management System (LMS)*** aims to streamline and automate the operations of a library, addressing various challenges faced in traditional manual systems. The key problem with manual library management is inefficiency and inaccuracies in tasks such as book borrowing, returning, cataloguing, and tracking book availability. These processes can be time-consuming, error-prone, and lack real-time insights into the library's inventory and usage patterns.

The ***primary goal of the LMS*** is to provide a centralized and user-friendly platform for both librarians and library members to manage library resources efficiently. The system should allow librarians to update, organize, and monitor the library collection, including books, magazines, journals, and other materials. Additionally, library members should be able to search for available resources, place holds, borrow, renew, and return items with ease.

The LMS should include features for generating reports, managing user accounts, tracking overdue items, and handling fine payments. Data security and privacy are also crucial aspects to be considered, ensuring that sensitive information is protected and accessible only to authorized personnel.

To help organize a library, we have decided to create a database. It would be ideal for a library upgrading from a card or paper system where they have a card for each piece of media and for each customer or patron. It would also benefit a library where all employee records are still on a paper basis as well including all hire paperwork and payroll information such as salary. As you can imagine for a paper system, it makes figuring out how many books are overdue, or how many people owe fees, take quite a while to figure out for the employees. Patrons also have no control over the system.

To replace the current card and paper system, we will use this database and it is its main purpose. All tasks previously recorded on paper or cards will be integrated into the new system. For example, based on due dates, librarians can run reports to see who has late books (checked out media report), who owes fees for late books or damaged books (cost report) and much more. It will only take a few seconds to run the report as opposed to going through all the cards by hand, saving the librarians hours a week.

Roles and Responsibilities of Personas:

a) Librarian: The librarian is responsible for managing the library system, maintaining the database, adding new books, handling user accounts, processing book requests, generating reports, and ensuring the smooth functioning of the LMS.

b) Library Staff: The library staff assists the librarian in day-to-day operations, including book shelving, managing returned books, handling book reservations, assisting users with queries, and maintaining a clean and organized library environment.

c) Library Users (Patrons): The users have access to the LMS and can search for books, check availability, borrow, renew, and reserve books. They can also pay fines for overdue books and provide feedback on their library experience.

The **Library Management System** is expected to meet following **key business requirements**:

a) User Authentication:

- Secure login and registration for librarians and library users.
- Role-based access control to restrict actions based on user roles.

b) Book Management:

- Add, update, delete book records with details like title, author, ISBN, & category.
- Track book availability and location within the library.

c) Borrowing and Returns:

- Allow users to borrow and return books with due date tracking.
- Automatically calculate and impose fines for late returns.

d) Book Search:

- Provide an advanced search interface with various filters.

e) Reservation System:

- Allow users to reserve books that are currently unavailable.

f) Reporting and Analytics:

- Generate reports on book circulation, popular titles, and user activity.
- Provide statistics on overdue books and fines collected.

g) Online Payments:

- Enable online fine payment and keep a record of transactions.

h) Notifications:

- Send automated email reminders for overdue books and reservation pickups.

2. Project features identified:

Feature ID	Feature name	Description
F01	User Management	This feature allows librarians to manage user accounts, issue library cards, and handle user-related tasks.
F02	Book Cataloging	Librarians can add, update, and delete book records with detailed information like title, author, ISBN, etc.
F03	Borrowing and Returns	Users can borrow and return books, while the system automatically calculates and imposes fines for late returns.
F04	Online Book Search	Users can search for books using various filters like title, author, and category.
F05	Reservation System	Users can reserve books that are currently unavailable and get notified when the books become available.
F06	Reporting and Analytics	The system generates reports and statistics for administrators to analyze library usage and book circulation.
F07	Online Payments	Users can pay fines online securely through the application.
F08	Notifications	Automated email reminders are sent to users for overdue books and reservation pickups.

3. Software and hardware details

Platform	**Windows**
Frontend/console	**JavaScript, Ajax, HTML5, CSS3**
Backend/server	**PHP (WAMP Server)**
Database	**MySQL**
Programming Language : Frontend	**JavaScript, HTML, CSS**
Backend/server: programming Language	**PHP (WAMP Server)**

4. Project Plan:

The project plan will involve the following stages:

a) Requirement Specification Document: Gather detailed requirements from stakeholders and document them.

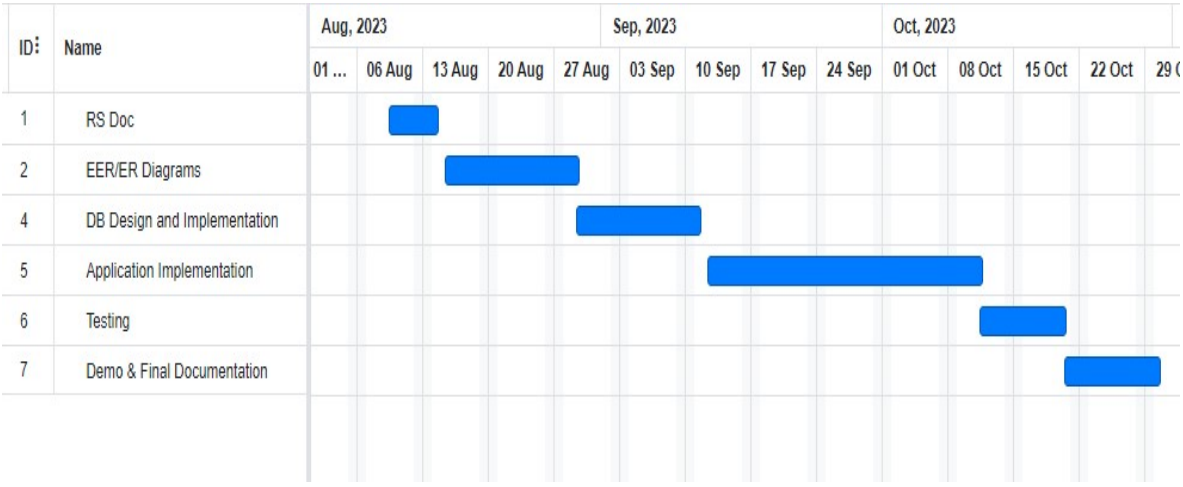
b) EER/ER diagrams: Design Entity-relationship diagrams as part of conceptual design phase.

c) DB Design and Implementation: Create the database schema, Database Normalization, table/data creation.

d) Application Implementation: Implement the application using the chosen technology stack. Design User Interfaces, coding of each feature, system architecture etc. Frontend, backend, and database connectivity related implementation.

e) Testing: Conduct thorough testing, including unit testing, integration testing, and user acceptance testing, database testing etc.

f) Demo & Final Documentation: Gather all project functional statistics and record a demo video. With this information, create and submit final documentation.

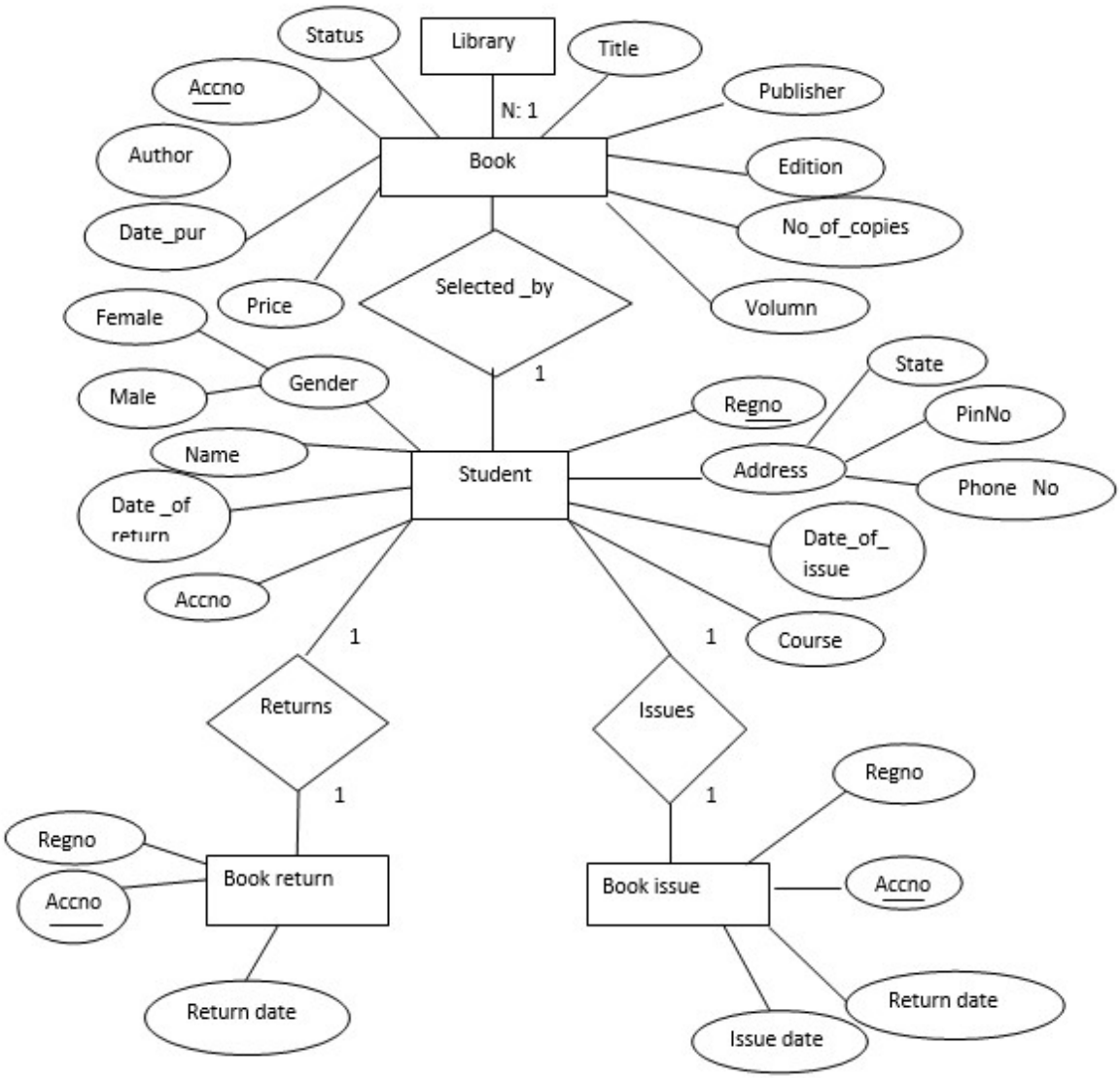


5. Google Drive Link for all deliverables:

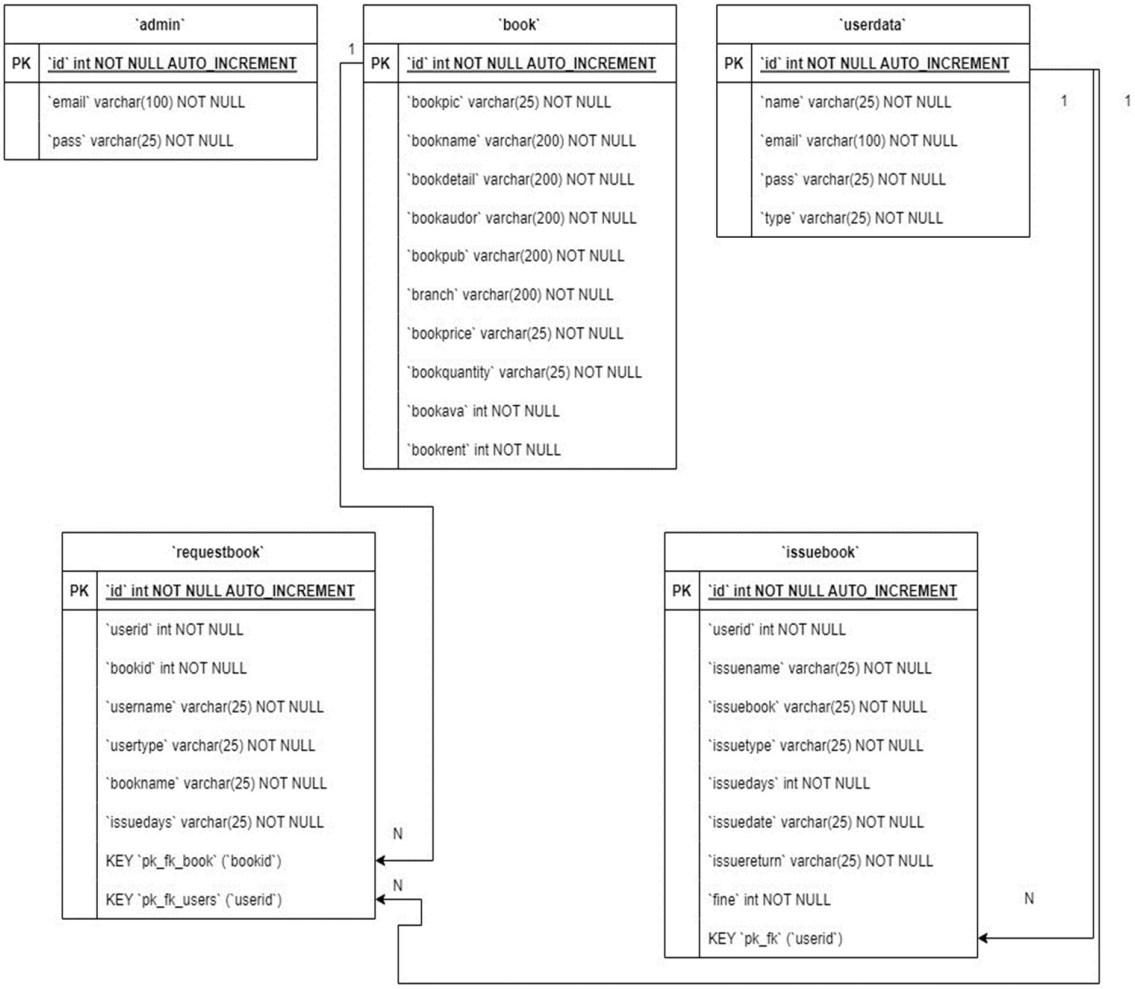
https://drive.google.com/drive/folders/14Y7oAMRhSacKphy7nwhFUXvYe_okZsAv?usp=drive_link

II. CONCEPTUAL DESIGN:

a. Entity Relationship Model



b. Object Model Diagram:

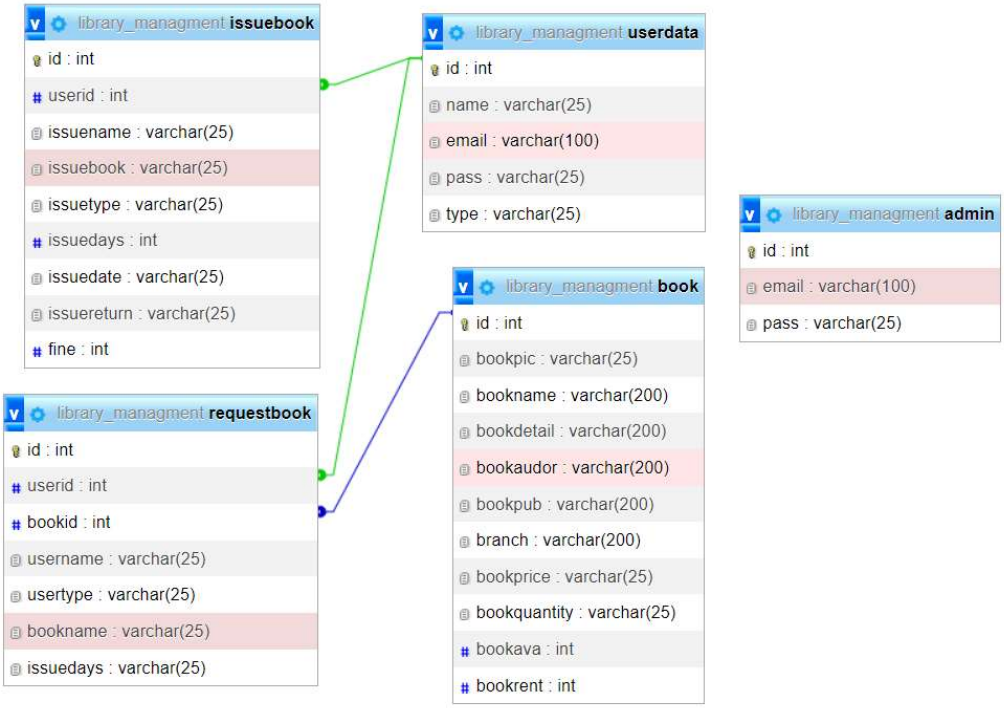


c. Google Drive Link for all Deliverables:

https://drive.google.com/drive/folders/14Y7oAMRhSacKphy7nwhFUXvYe_okZsAv?usp=drive_link

III. LOGICAL DESIGN

a. Relational Database Schema



b. Normalization

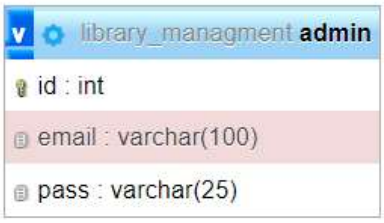
Database Name : library_management

#	Table Name	State	Reason
1	issuebook	3NF	No multivalued attributes, No partial dependencies, No transitive dependency
2	requestbook	3NF	No multivalued attributes, No partial dependencies, No transitive dependency
3	userdata	3NF	No multivalued attributes, No partial dependencies, No transitive dependency
4	book	3NF	No multivalued attributes, No partial dependencies, No transitive dependency
5	admin	3NF	No multivalued attributes, No partial dependencies, No transitive dependency

c. Create Data Dictionary

Table Definitions and Data Contents :

1. admin table

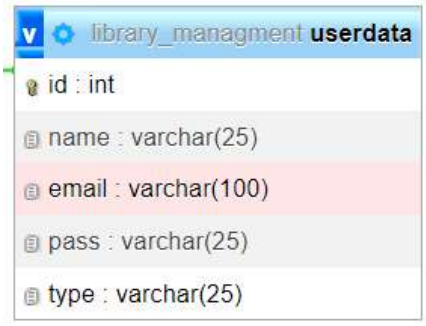


id	email	pass
1	admin@gmail.com	123

2. book table

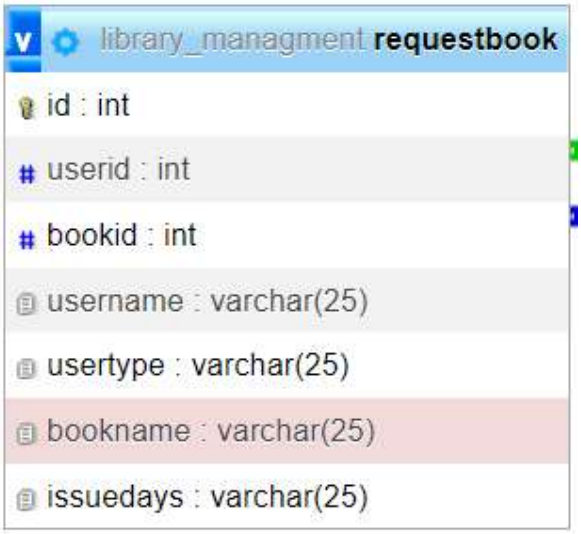
id	bookpic	bookname	bookdetail	bookaudor	bookpub	branch	bookprice	bookquantity	bookava	bookrent
1	1.jpg	Fundamentals of Database System	7th edition, 2017	Ramez Elamsri and Shamkant Navathe	Pearson Education	IT	490	100	100	0
2	2.jpg	Database System Concepts	6th edition, 2013	Abraham Silberschatz and Henry F Korth and S Sudar...	McGraw Hill	IT	264	100	100	0
3	3.jpg	An Introduction to Database Systems	8th edition, 2006	Christopher J. Date	Addison Wesley	IT	579	100	100	0

3. userdata table



id	name	email	pass	type
1	akshay_shelke	2022mt93331@wilp.bits-pilani.ac.in	123	student
2	john_doe	johndoe@gmail.com	123	student

4. requestbook table



id	userid	bookid	username	usertype	bookname	issuedays
7	1	1	akshay_shelke	student	Fundamentals of Database System	7
8	1	3	akshay_shelke	student	An Introduction to Database Systems	7

5. issuebook table

id	userid	issuename	issuebook	issuetype	issuedays	issuedate	issuereturn	fine
12	1	akshay_shelke	Fundamentals of Database System	student	7	27/10/2023	03/11/2023	0
13	1	akshay_shelke	An Introduction to Database Systems	student	7	27/10/2023	03/11/2023	0

d. Google Drive Link for all Deliverables:
https://drive.google.com/drive/folders/14Y7oAMRhSacKphy7nwhFUXvYe_okZsAv?usp=drive_link

IV. PHYSICAL DESIGN

a. SQL Statements Database Schema

```
SET SQL_MODE = "NO_AUTO_VALUE_ON_ZERO";
START TRANSACTION;
SET time_zone = "+00:00";

--
-- Database: `library_managment`
--

--
-- Table structure for table `admin`
--

CREATE TABLE `admin` (
  `id` int(11) NOT NULL,
  `email` varchar(500) NOT NULL,
  `pass` varchar(500) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4;

--
-- Dumping data for table `admin`
--

INSERT INTO `admin` (`id`, `email`, `pass`) VALUES
(1, 'admin@gmail.com', '123');

-- --------------------------------------------------------
```

```
--
-- Table structure for table `book`
--

CREATE TABLE `book` (
  `id` int(11) NOT NULL,
  `bookpic` varchar(500) NOT NULL,
  `bookname` varchar(500) NOT NULL,
  `bookdetail` varchar(500) NOT NULL,
  `bookaudor` varchar(500) NOT NULL,
  `bookpub` varchar(500) NOT NULL,
  `branch` varchar(500) NOT NULL,
  `bookprice` varchar(500) NOT NULL,
  `bookquantity` varchar(500) NOT NULL,
  `bookava` int(11) NOT NULL,
  `bookrent` int(11) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4;

--
-- Dumping data for table `book`
--

INSERT INTO `book` (`id`, `bookpic`, `bookname`, `bookdetail`,
`bookaudor`, `bookpub`, `branch`, `bookprice`, `bookquantity`,
`bookava`, `bookrent`) VALUES
(1, '1.jpg', 'Fundamentals of Database System', '7th edition, 2017',
'Ramez Elamsri and Shamkant Navathe', 'Pearson Education', 'IT',
'490', '100', 100, 0),
(2, '2.jpg', 'Database System Concepts', '6th edition, 2013', 'Abraham
Silberschatz and Henry F Korth and S Sudarshan', 'McGraw Hill', 'IT',
'264', '100', 100, 0),
(3, '3.jpg', 'An Introduction to Database Systems', '8th edition, 2006',
'Christopher J. Date', 'Addison Wesley', 'IT', '579', '100', 100, 0);

-- --------------------------------------------------------
```

```
--
-- Table structure for table `issuebook`
--

CREATE TABLE `issuebook` (
  `id` int(11) NOT NULL,
  `userid` int(11) NOT NULL,
  `issuename` varchar(500) NOT NULL,
  `issuebook` varchar(500) NOT NULL,
  `issuetype` varchar(500) NOT NULL,
  `issuedays` int(11) NOT NULL,
  `issuedate` varchar(500) NOT NULL,
  `issuereturn` varchar(500) NOT NULL,
  `fine` int(11) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4;

--
-- Dumping data for table `issuebook`
--

-- --------------------------------------------------------

--
-- Table structure for table `requestbook`
--

CREATE TABLE `requestbook` (
  `id` int(11) NOT NULL,
  `userid` int(11) NOT NULL,
  `bookid` int(11) NOT NULL,
  `username` varchar(500) NOT NULL,
  `usertype` varchar(500) NOT NULL,
  `bookname` varchar(500) NOT NULL,
  `issuedays` varchar(500) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4;

-- --------------------------------------------------------
```

```
--
-- Table structure for table `userdata`
--

CREATE TABLE `userdata` (
  `id` int(11) NOT NULL,
  `name` varchar(500) NOT NULL,
  `email` varchar(100) NOT NULL,
  `pass` varchar(500) NOT NULL,
  `type` varchar(500) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4;

--
-- Dumping data for table `userdata`
--

INSERT INTO `userdata` (`id`, `name`, `email`, `pass`, `type`) VALUES
(1, 'akshay_shelke', '2022mt93331@wilp.bits-pilani.ac.in', '123',
'student'),
(2, 'john_doe', 'johndoe@gmail.com', '123', 'student');

--
-- Indexes for dumped tables
--

--
-- Indexes for table `admin`
--
ALTER TABLE `admin`
  ADD PRIMARY KEY (`id`);

--
-- Indexes for table `book`
--
ALTER TABLE `book`
  ADD PRIMARY KEY (`id`);

--
-- Indexes for table `issuebook`
--
```

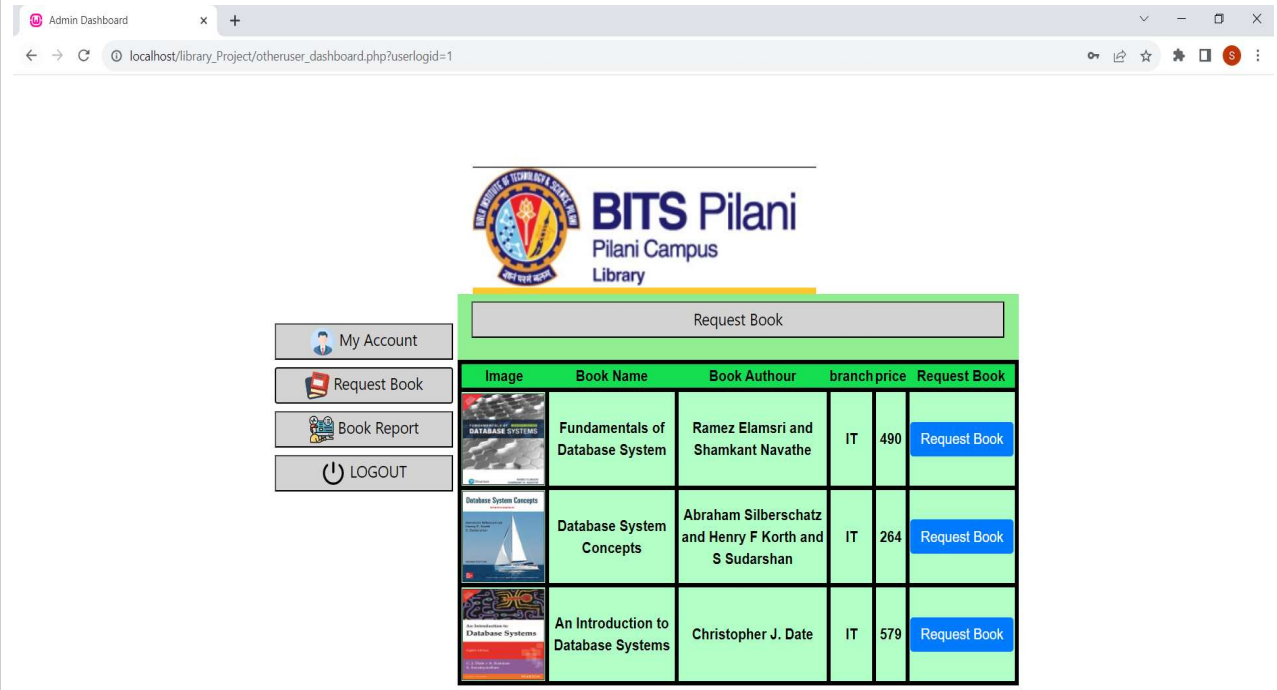
```
ALTER TABLE `issuebook`
  ADD PRIMARY KEY (`id`),
  ADD KEY `pk_fk` (`userid`);

--
-- Indexes for table `requestbook`
--
ALTER TABLE `requestbook`
  ADD PRIMARY KEY (`id`),
  ADD KEY `pk_fk_book` (`bookid`),
  ADD KEY `pk_fk_users` (`userid`);

--
-- Indexes for table `userdata`
--
ALTER TABLE `userdata`
  ADD PRIMARY KEY (`id`);

--
-- AUTO_INCREMENT for dumped tables
--


--
-- AUTO_INCREMENT for table `admin`
--
ALTER TABLE `admin`
  MODIFY `id` int(11) NOT NULL AUTO_INCREMENT,
AUTO_INCREMENT=2;

--
-- AUTO_INCREMENT for table `book`
--
ALTER TABLE `book`
  MODIFY `id` int(11) NOT NULL AUTO_INCREMENT,
AUTO_INCREMENT=7;

--
-- AUTO_INCREMENT for table `issuebook`
--
ALTER TABLE `issuebook`
  MODIFY `id` int(11) NOT NULL AUTO_INCREMENT,
AUTO_INCREMENT=12;
```

```
--
-- AUTO_INCREMENT for table `requestbook`
--
ALTER TABLE `requestbook`
  MODIFY `id` int(11) NOT NULL AUTO_INCREMENT,
AUTO_INCREMENT=7;

--
-- AUTO_INCREMENT for table `userdata`
--
ALTER TABLE `userdata`
  MODIFY `id` int(11) NOT NULL AUTO_INCREMENT,
AUTO_INCREMENT=6;

--
-- Constraints for dumped tables
--


--
-- Constraints for table `issuebook`
--
ALTER TABLE `issuebook`
  ADD CONSTRAINT `pk_fk` FOREIGN KEY (`userid`)
REFERENCES `userdata` (`id`);

--
-- Constraints for table `requestbook`
--
ALTER TABLE `requestbook`
  ADD CONSTRAINT `pk_fk_users` FOREIGN KEY (`userid`)
REFERENCES `userdata` (`id`);
COMMIT;

ALTER TABLE `requestbook`
  ADD CONSTRAINT `pk_fk_book` FOREIGN KEY (`bookid`)
REFERENCES `book` (`id`);
COMMIT;
```

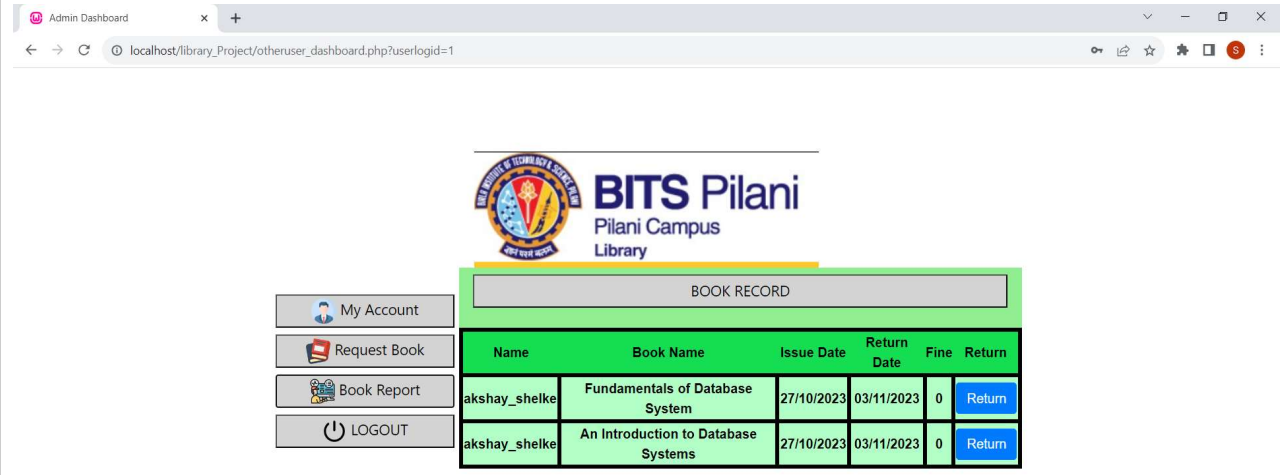
b. Stored Procedures/ Triggers/indexes
- Please refer above SQL Statements

c. User Interface and Database connectivity

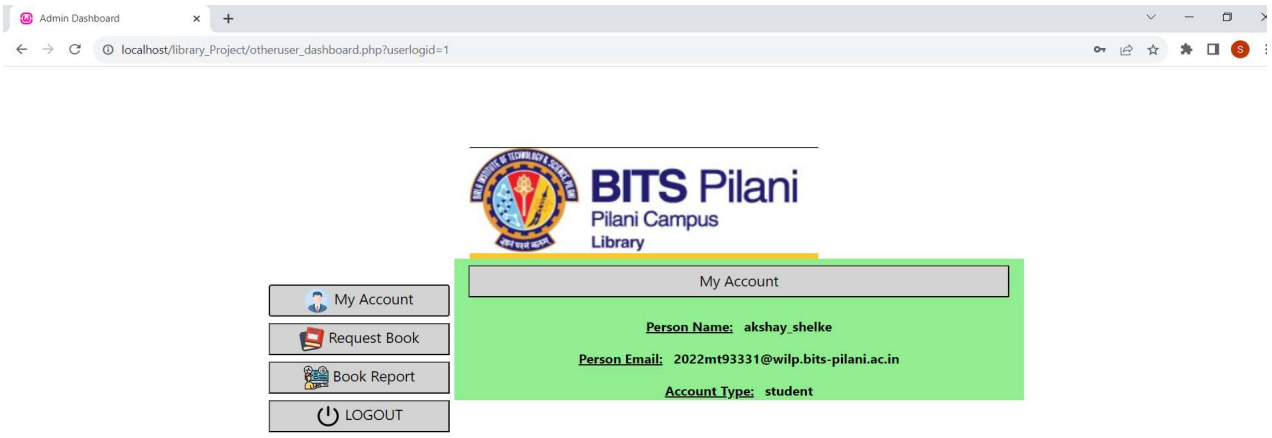
Screen #1



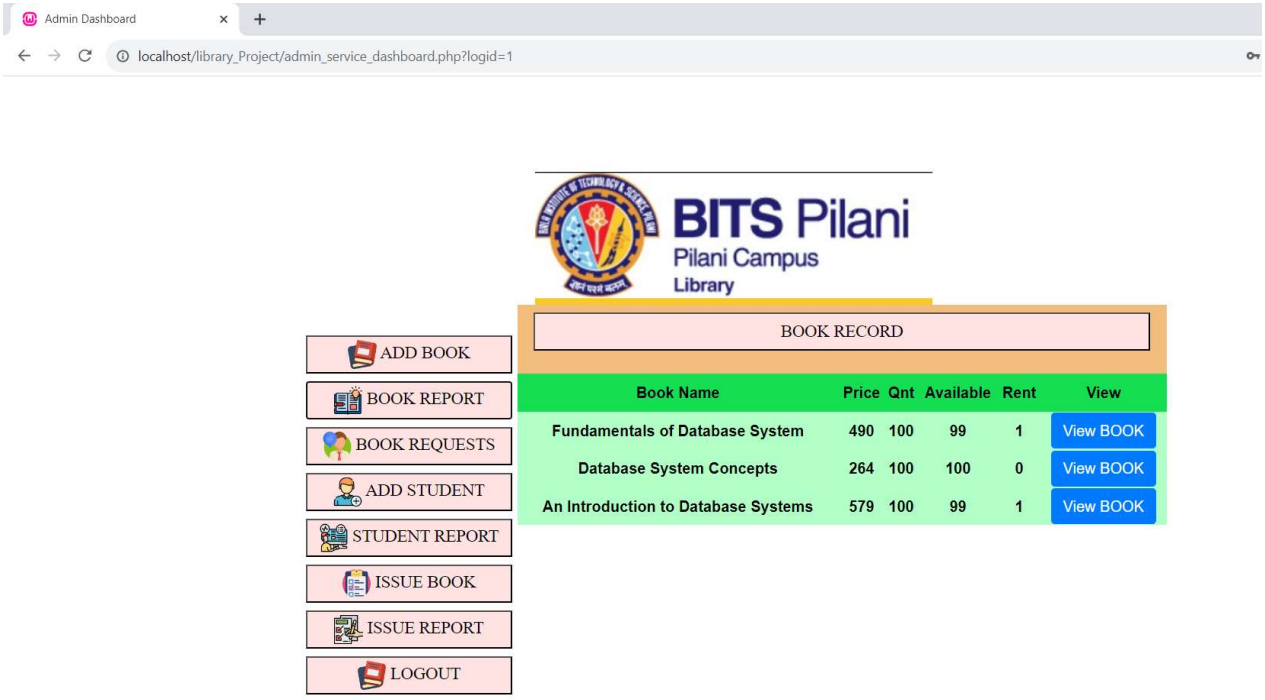
Screen #2



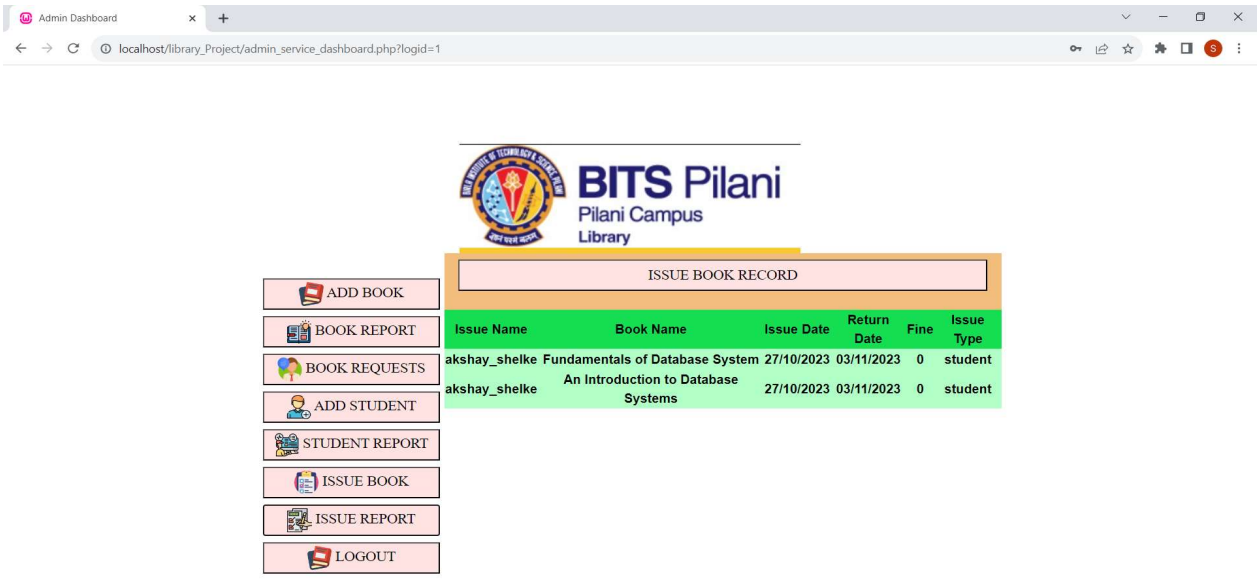
Screen #3



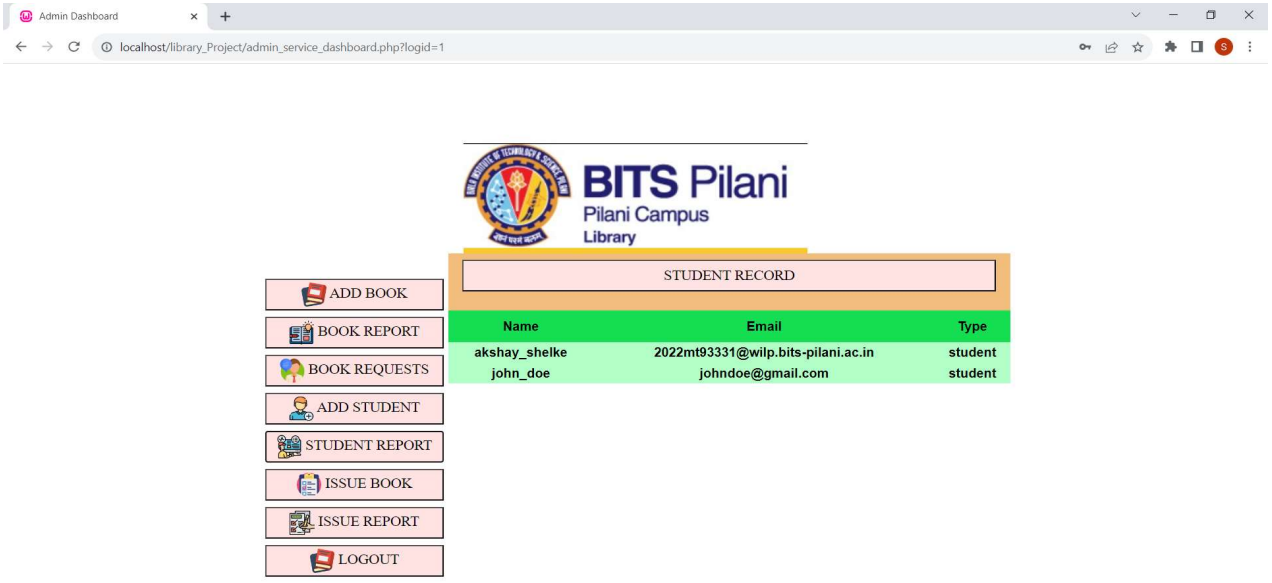
Screen #4



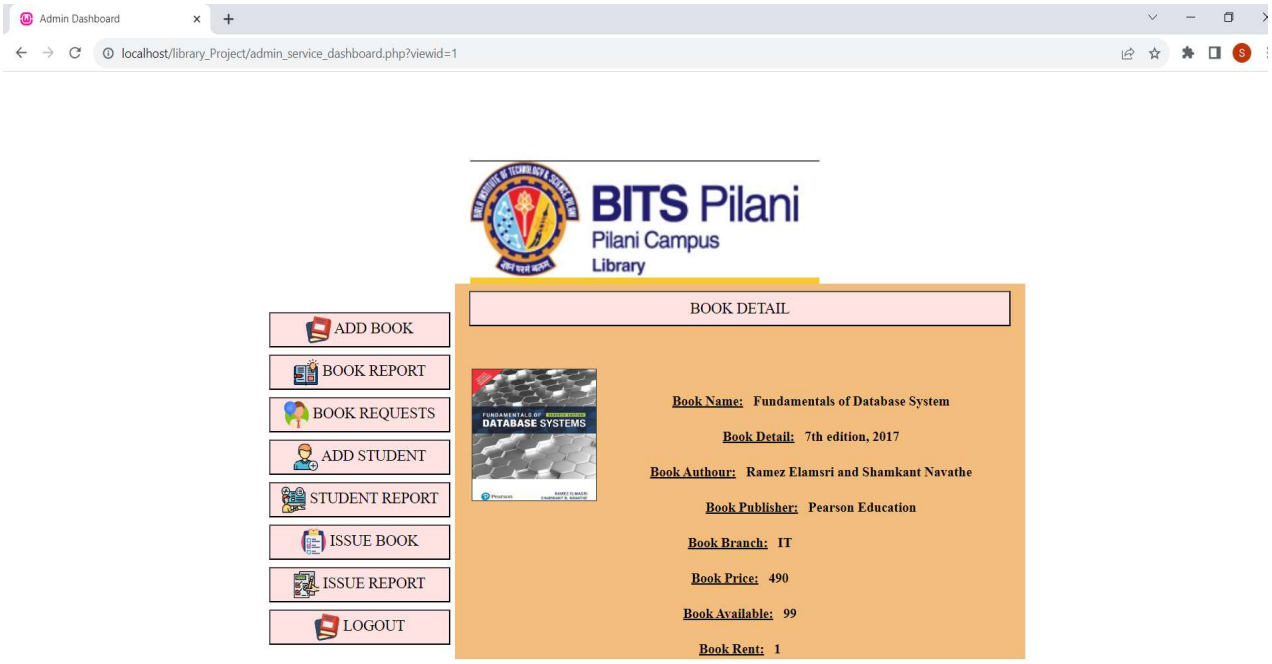
Screen #5



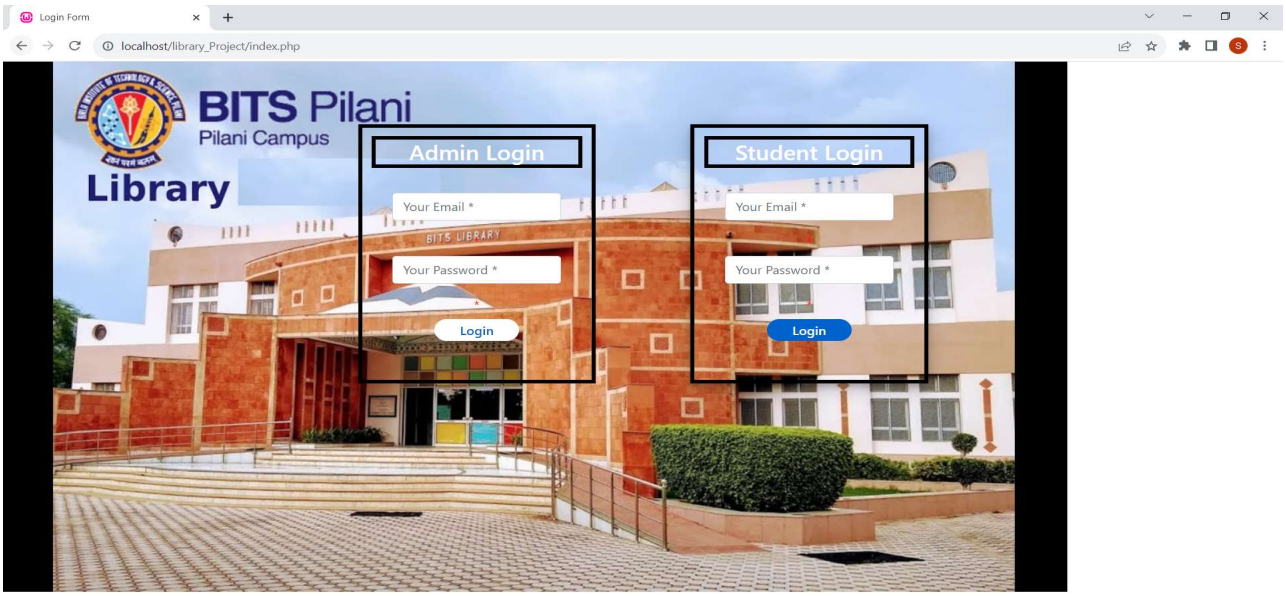
Screen #6



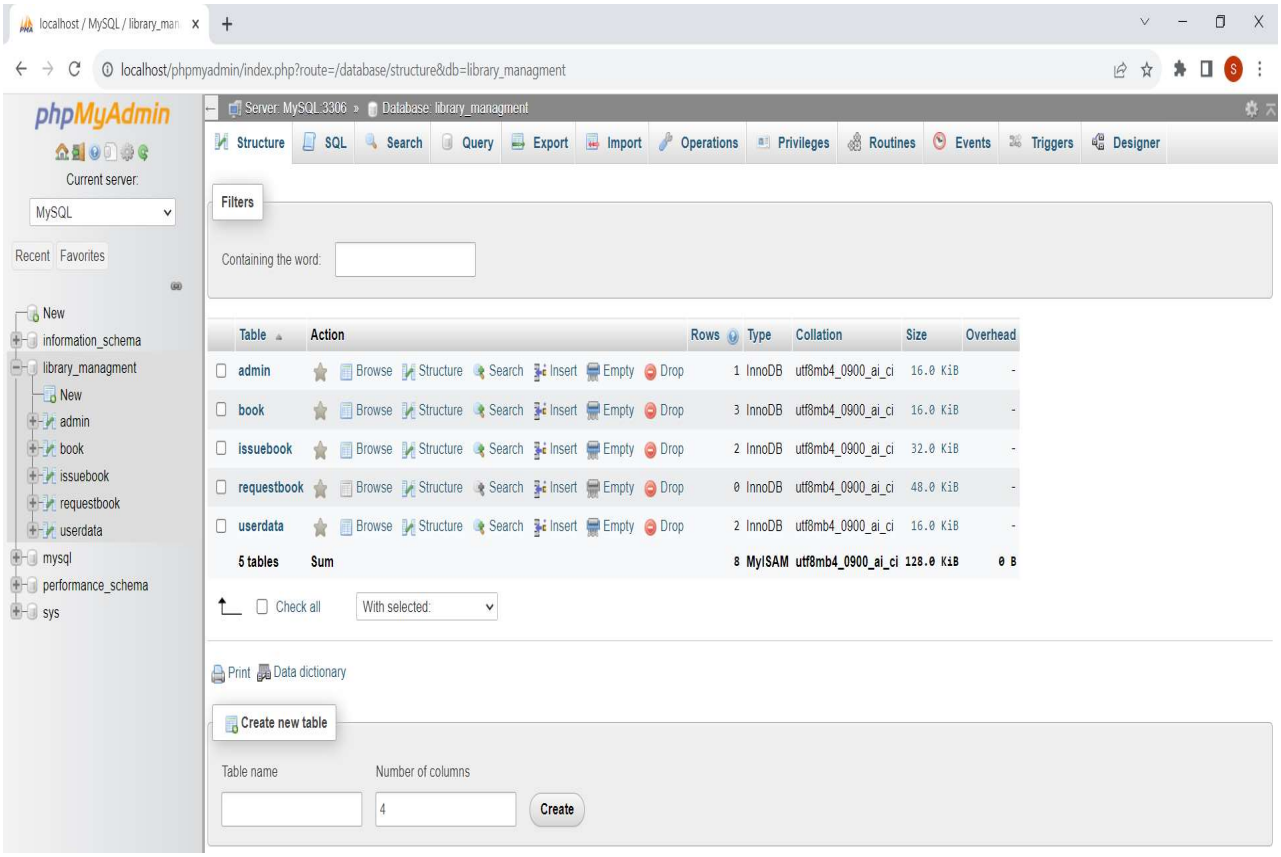
Screen #7



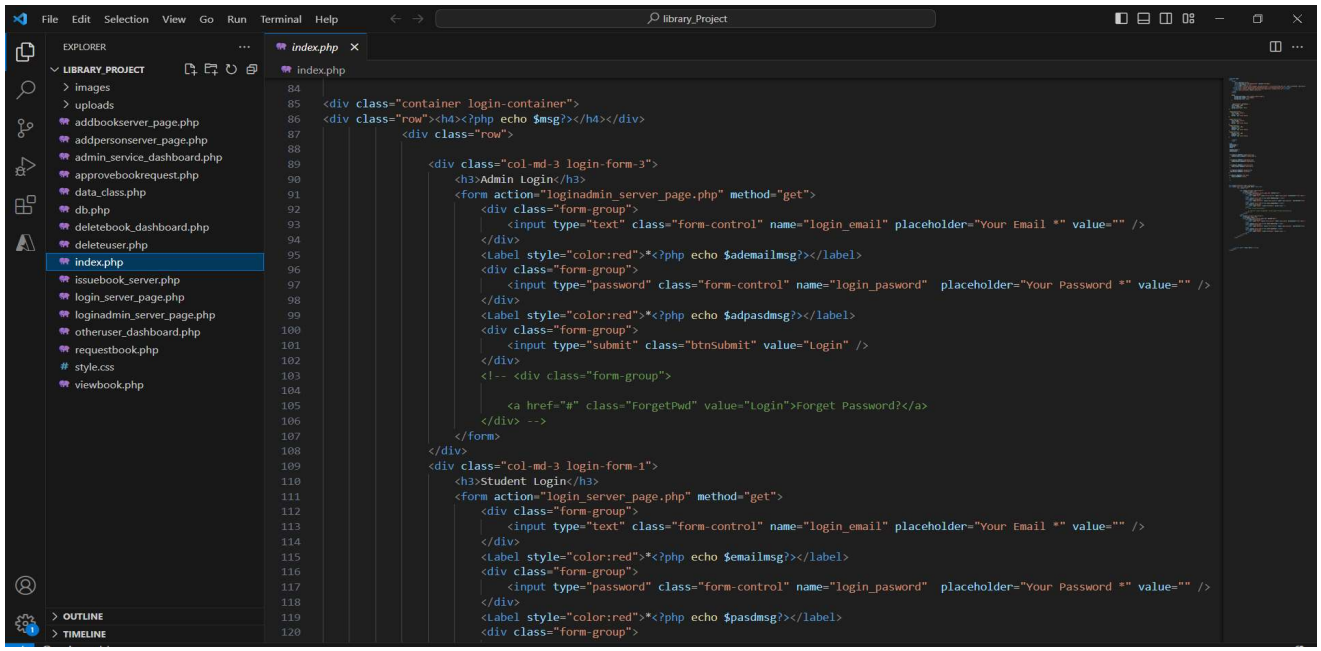
Login Screen



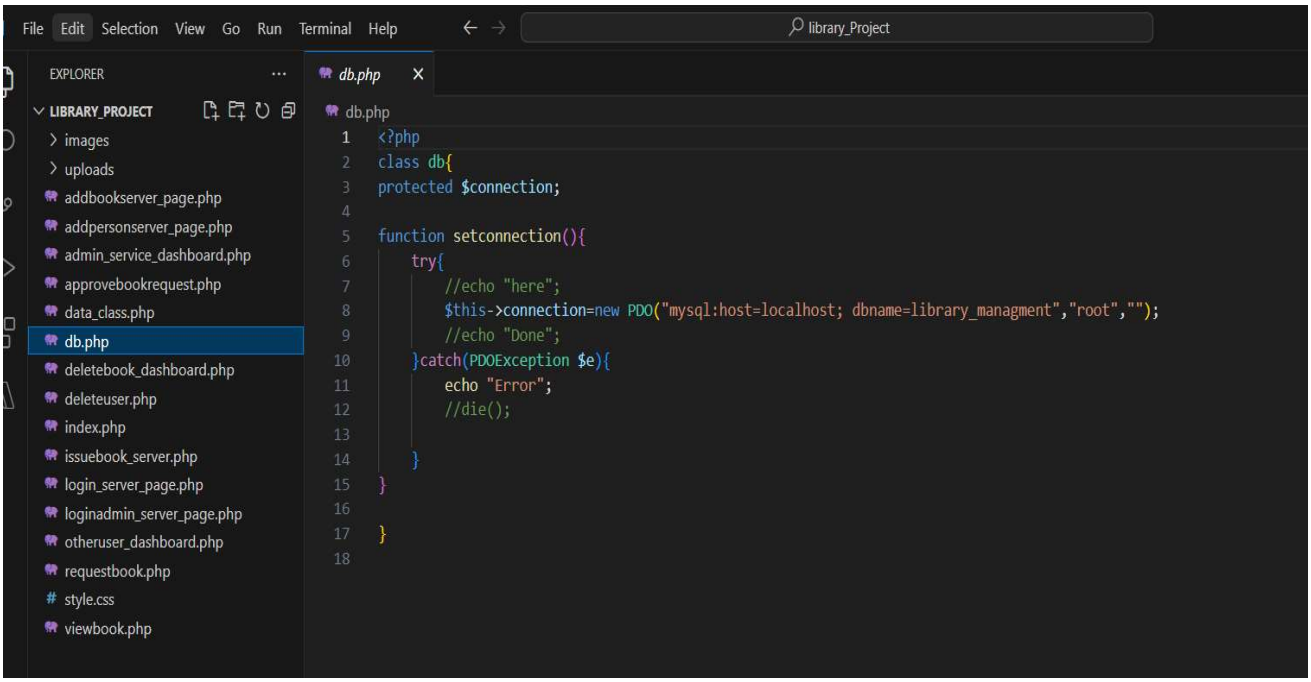
Database


localhost / MySQL / library_man
localhost/phpmyadmin/index.php?route=/database/structure&db=library_managment
phpMyAdmin
Current server:
MySQL
Recent
Favorites
New
information_schema
library_managment
New
admin
book
issuebook
requestbook
userdata
mysql
performance_schema
sys
Server: MySQL:3306 » Database: library_managment
Structure
SQL
Search
Query
Export
Import
Operations
Privileges
Routines
Events
Triggers
Designer
Filters
Containing the word:
Table
Action
Rows
Type
Collation
Size
Overhead
admin Browse Structure Search Insert Empty Drop 1 InnoDB utf8mb4_0900_ai_ci 16.0 KiB -
book Browse Structure Search Insert Empty Drop 3 InnoDB utf8mb4_0900_ai_ci 16.0 KiB -
issuebook Browse Structure Search Insert Empty Drop 2 InnoDB utf8mb4_0900_ai_ci 32.0 KiB -
requestbook Browse Structure Search Insert Empty Drop 0 InnoDB utf8mb4_0900_ai_ci 48.0 KiB -
userdata Browse Structure Search Insert Empty Drop 2 InnoDB utf8mb4_0900_ai_ci 16.0 KiB -
5 tables Sum 8 MyISAM utf8mb4_0900_ai_ci 128.0 KiB 0 B
Check all
With selected:
Print
Data dictionary
Create new table
Table name
Number of columns
4
Create

Index.php

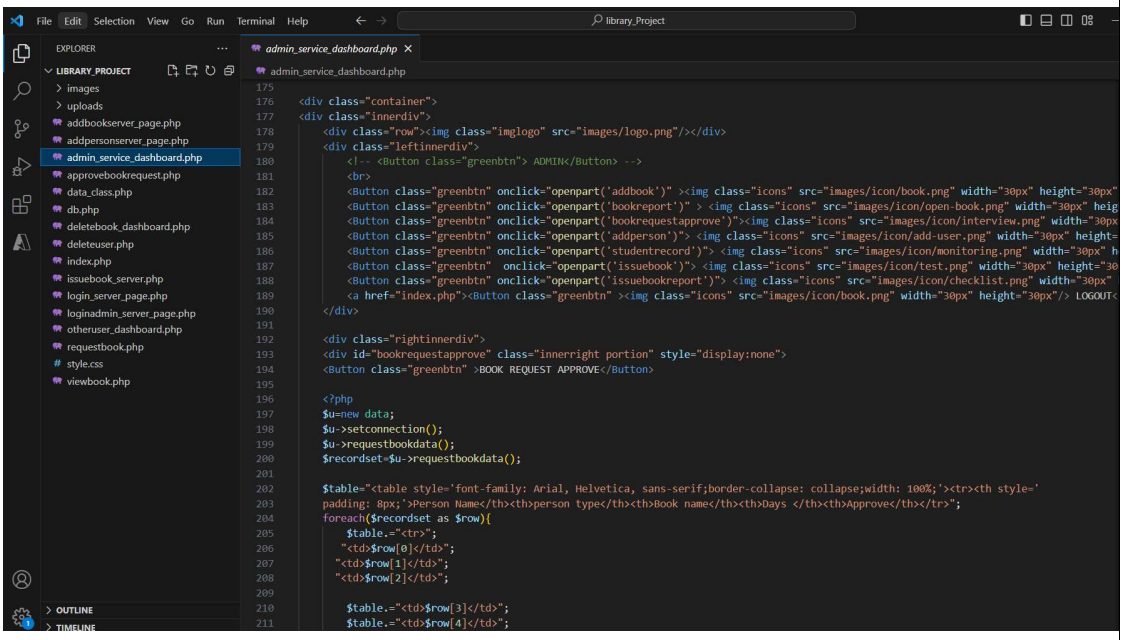


DATABASE Connection Code in php

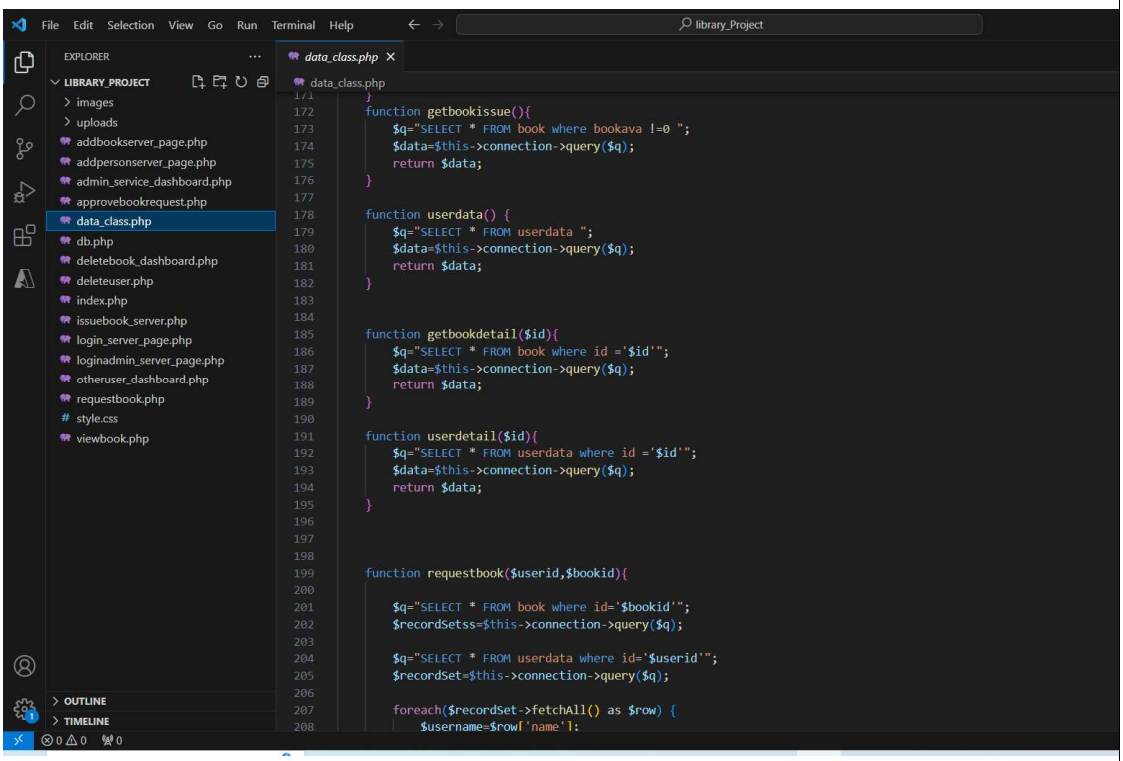


d. Front end or console based codes.

Admin Service Dashboard



Data class to interact with UI and Database

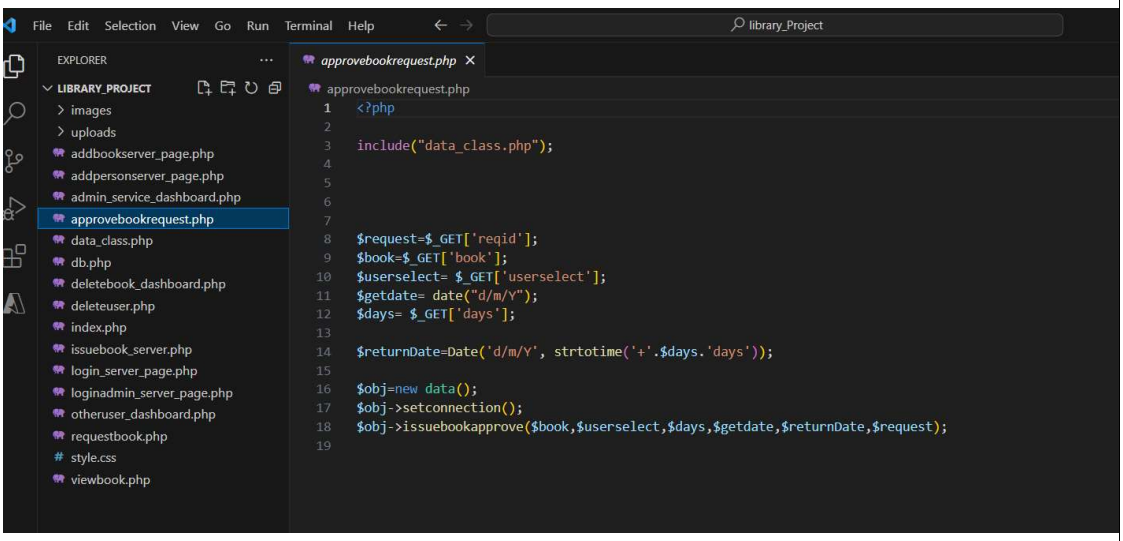


Request Book

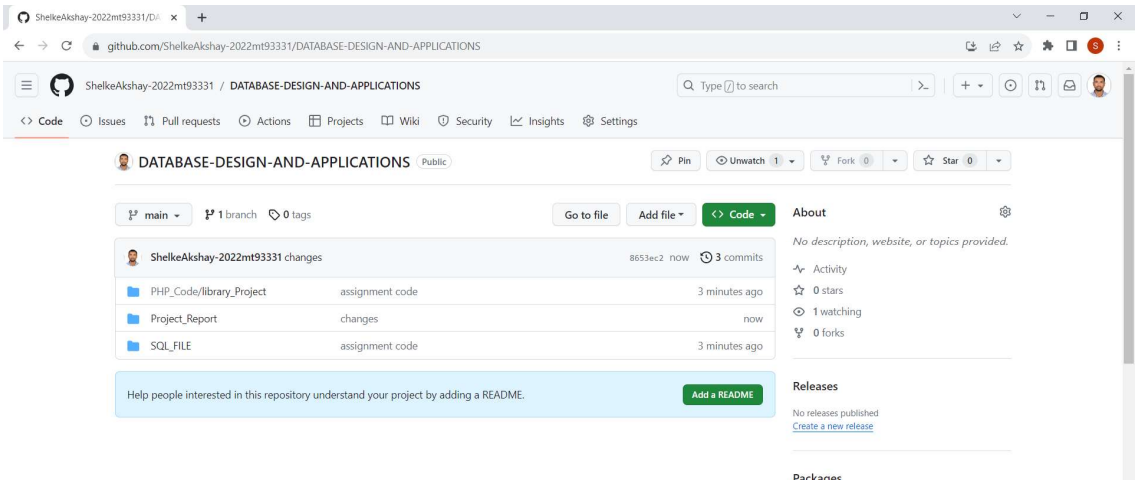
requestbook.php

```php
<?php

include("data_class.php");

$userid=$_GET['userid'];
$bookid=$_GET['bookid'];









$obj=new data();
$obj->setconnection();
$obj->requestbook($userid,$bookid);

?>
```

Approve Book Request



GIT Hub Link for all code files :
Link: https://github.com/ShelkeAkshay-2022mt93331/DATABASE-DESIGN-AND-APPLICATIONS



e. **Google Drive Link for all Deliverables:**
https://drive.google.com/drive/folders/14Y7oAMRhSacKphy7nwhFUXvYe_okZsAv?usp=drive_link

V. FINAL DOC

a. TEST CASES for each functionality in the applications.

TEST CASES

Task Name	Test ID	Test Data	Expected Output	Actual Output	Test Pass or Fail
Admin Login	1	Valid username and password	Successful login	Successful login	Pass
	2	Invalid username or password	Error message: "Invalid credentials"	Error message: "Invalid credentials"	Pass
User Registration	3	Valid user data (name, email, password)	User successfully registered	User successfully registered	Pass
	4	Invalid user data (e.g., missing email)	Error message: "Invalid user data"	Error message: "Invalid user data"	Pass
Add Book	5	Valid book information (title, author, ISBN)	Book added successfully	Book added successfully	Pass
	6	Invalid book information (e.g., missing title)	Error message: "Invalid book information"	Error message: "Invalid book information"	Pass
Search Book	7	Valid book title or author	List of matching books	List of matching books	Pass

	8	Invalid book title or author	No matching books found	No matching books found	Pass
Request Book	9	User requests a book	Request submitted successfully	Request submitted successfully	Pass
	10	User requests a book that's not available	Error message: "Book not available for request"	Error message: "Book not available for request"	Pass
Issue Book	11	User requests an available book	Book issued successfully	Book issued successfully	Pass
	12	User requests a book that's already issued	Error message: "Book already issued"	Error message: "Book already issued"	Pass
Return Book	13	User returns an issued book	Book returned successfully	Book returned successfully	Pass
	14	User returns a book that's not issued	Error message: "Book not issued to the user"	Error message: "Book not issued to the user"	Pass
View User Data	15	Admin views user data	User data displayed	User data displayed	Pass
View Book Data	16	Admin views book data	Book data displayed	Book data displayed	Pass

b. DEMO VIDEO
Video Link:

YouTube : https://www.youtube.com/watch?v=TRiN8ryT1bs

Google Drive :
https://drive.google.com/file/d/1ARa_VeQjKZbxzCeiP8DTEDJUtLks6kES/view?usp=sharing

GIT Hub Link for all code files :
Link: https://github.com/ShelkeAkshay-2022mt93331/DATABASE-DESIGN-AND-APPLICATIONS

c. references:

1. **Silberschatz, A., Korth, H. F., & Sudarshan, S. (2010). Database System Concepts (6th ed.). McGraw-Hill.**

2. **Bind, P. S., & Suradkar, S. S. (2019). Library Management System. Pearson.**

3. **Healey, D. (2008). Best Practices in Library Management Systems. Journal of Academic Librarianship, 34(6), 520-526.**

4. **Chen, P. P. (1976). The Entity-Relationship Model - Toward a Unified View of Data. ACM Transactions on Database Systems, 1(1), 9-36.**

5. **Elmasri, R., & Navathe, S. B. (2016). Fundamentals of Database Systems (7th ed.). Pearson.**

d. Google Drive Link for all Deliverables:
https://drive.google.com/drive/folders/14Y7oAMRhSacKphy7nwhFUXvYe_okZsAv?usp=drive_link